

WHAT IS CLAIMED IS:

1. A curve's radius estimation device for
estimating a curve's radius of a road on which a vehicle
5 shall run, comprising:

a vehicle speed sensor for detecting an actual
speed of the vehicle;

a yaw rate sensor for detecting an actual yaw rate
of the vehicle;

10 a steering angle sensor for detecting an angle of
a steering wheel handled by a driver of the vehicle as an
actual steering angle; and

an estimator for estimating the curve's radius on
the basis of the actual vehicle speed detected by the vehicle
15 speed sensor, the actual yaw rate detected by the yaw rate
sensor, and the actual steering angle detected by the
steering angle sensor.

2. The curve's radius estimation device as claimed
20 in claim 1, the estimator comprising:

a base value estimation part for estimating the
curve's radius as a base value on the basis of the actual
vehicle speed and the actual yaw rate but not of the steering
angle; and

25 an estimation part for determining an amount of
correction for the base value on the basis of physical
quantity regarding the steering angle, and estimating the
curve's radius by correcting the base value with the amount
of correction.

30 3. The curve's radius estimation device as claimed
in claim 2, the estimator further comprising an enabling part
for enabling the estimation of the curve's radius when an

expected value of the curve's radius is equal to or below a predetermined value and a state of temporal variation of the curve's radius does not exceed a predetermined state for a predetermined time period or longer.

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4. The curve's radius estimation device as claimed in claim 3, the estimator further comprising a setting part for setting the predetermined time period such that the predetermined time period is shortened as the actual vehicle speed increases.

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5. The curve's radius estimation device as claimed in claim 1, the estimator comprising an estimation part for estimating the curve's radius such that an estimate of the curve's radius responds to the variation of the actual steering angle more sensitively when an expected value of the curve's radius is relatively small than when the expected value is relatively large.

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6. The curve's radius estimation device as claimed in claim 2, the estimator further comprising a part for determining the amount of correction for the base value using a product of an amount of variation of the base value per a certain range of the actual steering angle, an amount of variation of the actual steering angle per a certain time period, and a coefficient that increases as an expected value of the curve's radius decreases, and estimating the curve's radius by correcting the base value with the determined amount of correction.

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7. A curve's radius estimation device for estimating a curve's radius of a road on which a vehicle shall run, comprising:

a vehicle speed sensor for detecting an actual speed of the vehicle;

a yaw rate sensor for detecting an actual yaw rate of the vehicle;

5 a steering angle sensor for detecting an angle of a steering wheel handled by a driver of the vehicle as an actual steering angle; and

an estimator for estimating the curve's radius, the estimator comprising:

10 a first estimation part for estimating the curve's radius on the basis of the actual vehicle speed and the actual yaw rate but not of the actual steering angle as a first estimate;

a second estimation part for estimating the
15 curve's radius on the basis of the actual vehicle speed, the actual yaw rate, and the actual steering angle as a second estimate; and

a final value acquisition part for acquiring a final value of the estimate of the curve's radius using
20 selectively or collectively those estimated first and second estimates.

8. The curve's radius estimation device as claimed in claim 7, the final value acquisition part comprising a
25 selection part for selecting the larger one of the first and second estimates as the final value of the curve's radius.

9. The curve's radius estimation device as claimed in claim 7, the estimator further comprising an enabling part
30 for enabling the acquisition of the second estimate when an expected value of the curve's radius is equal to or below a predetermined value and a state of temporal variation of the first estimate does not exceed a predetermined state for a

predetermined time period or longer.

10. The curve's radius estimation device as
claimed in claim 9, the estimator further comprising a
5 setting part for setting the predetermined time period such
that the predetermined time period is shortened as the actual
vehicle speed increases.

11. The curve's radius estimation device as
10 claimed in claim 7, the second estimation part comprising a
part for acquiring the second estimate on the basis of an
amount of variation of the first estimate per a certain range
of the actual steering angle and an amount of variation of
the actual steering angle per a certain time period.

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12. The curve's radius estimation device as
claimed in claim 7, the second estimation part comprising a
part for acquiring the second estimate using a product of an
amount of variation of the first estimate per a certain range
20 of the actual steering angle, an amount of variation of the
actual steering angle per a certain time period, and a
coefficient that increases as an expected value of the
curve's radius decreases.

25 13. The curve's radius estimation device as
claimed in claim 7, the second estimation part comprising a
part for determining an amount of correction for the first
estimate using a product of an amount of variation of the
first estimate per a certain range of the actual steering
30 angle, an amount of variation of the actual steering angle
per a certain time period, and a coefficient that increases
as an expected value of the curve's radius decreases, and
acquiring the second estimate by correcting the first

estimate with the determined amount of correction.

14. The curve's radius estimation device as claimed in claim 7, the first estimation part comprising a part for acquiring an original value of the first estimate on the basis of the actual vehicle speed and the actual yaw rate but not of the actual steering angle, and filtering the acquired original value with a particular characteristic so as to acquire a final value of the first estimate,

the particular characteristic being a low response characteristic to the original value in a region where the vehicle running state is expected to be nearly a straight running state, and being a high response characteristic to the original value in a region where the vehicle running state is expected to be nearly a turning state.

15. A curve's radius estimation device for estimating a curve's radius of a road on which a vehicle shall run, comprising:

a vehicle speed sensor for detecting an actual speed of the vehicle;

a yaw rate sensor for detecting an actual yaw rate of the vehicle; and

an estimator for acquiring an original value of the curve's radius on the basis of the actual vehicle speed detected by the vehicle speed sensor and the actual yaw rate detected by the yaw rate sensor, and filtering the acquired original value with a particular characteristic so as to acquire a final value of the curve's radius,

the particular characteristic being a low response characteristic to the original value in a region where the vehicle running state is expected to be nearly a straight running state, and being a high response characteristic to

the original value in a region where the vehicle running state is expected to be nearly a turning state.

16. The curve's radius estimation device as
5 claimed in any of claims 1-15, the estimator comprising a determination part for determining that the vehicle is under a straight running state when the actual vehicle speed is equal to or below a predetermined speed regardless of detected values of the actual yaw rate.

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17. A curve's radius estimation device for estimating a curve's radius of a road on which a vehicle shall run, comprising:

15 a vehicle speed sensor for detecting an actual vehicle speed of the vehicle;

a turning state quantity sensor for detecting a turning state quantity representing a turning state of the vehicle; and

20 an estimator for estimating the curve's radius on the basis of at least the turning state quantity of the actual vehicle speed detected by the vehicle speed sensor and the turning state quantity detected by the turning state quantity sensor,

25 the estimator determining that the vehicle is under a straight running state when the actual vehicle speed is equal to or below a predetermined speed regardless of detected values of the actual yaw rate.

18. A preceding vehicle existence determination
30 apparatus comprising:

the curve's radius estimation device claimed in any of claims 1-17;

a sensor provided in the vehicle for detecting an

object located in front of the vehicle; and

a determiner for determining a present lane probability in which a preceding vehicle is running on the same lane with the present vehicle when the object detected by the sensor is a moving object that is the preceding vehicle, and determining that a preceding vehicle exists for which the present vehicle should make track when the determined present lane probability is equal to or exceeds a predetermined probability,

the determiner determining the present lane probability on the basis of output signals of the sensor and the curve's radius estimated by the curve's radius estimation device in accordance with a predetermined relationship between at least one of a first distance and a second distance and the present lane probability, and,

the first distance representing how far the preceding vehicle is out of the lane in a lane-width direction, and the second distance representing how far the preceding vehicle is away from the present vehicle along with the lane in a vehicle traveling direction.